



Department for
Energy Security
& Net Zero

Energy and emissions projections 2023 to 2050

December 2024



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Any enquiries regarding this publication should be sent to us at: emissionsprojections@energysecurity.gov.uk

Table of Contents

Executive summary	4
1 Introduction	7
1.1 About this document	7
1.2 The “reference scenario” and other scenarios	10
2 UK emissions projections	11
2.1 Introduction	11
2.2 UK emissions projections and uncertainty	11
2.3 Progress towards the carbon budgets	13
3 Effect of policies on emissions	16
3.1 Introduction	16
3.2 Policies for emissions reduction	17
3.3 Changes to individually quantified policy savings since EEP 2022-2040	17
3.4 Emissions savings from policies in electricity supply	18
4 Electricity supply	20
4.1 Introduction	20
4.2 Summary of projections	20
5 Detailed comparisons with EEP 2022-2040	22
5.1 Introduction	22
5.2 Changes in emissions (including international aviation and shipping) since EEP 2022-2040	22
5.2.1 Changes to projections of emissions (including international aviation and shipping) due to input updates	24
6 Lists of supporting material	26
6.1 Annexes	26
6.2 Web tables and figures	27

Executive summary

The Department for Energy Security & Net Zero (DESNZ) publishes annual projections of UK energy demand and greenhouse gas emissions (EEP)¹. This report contains outputs from the latest projections, Energy and Emissions Projections 2023-2050 (EEP 2023-2050), along with comparisons to EEP 2022-2040.

The DESNZ Energy and Emissions Projections (EEP) provides projections of greenhouse gas emissions. These projections take account of any policies that, as of June 2024, have either been implemented or those that are planned where the level of funding has been agreed and the policy design is near final. These are referred to as EEP-ready policies. Policies at an earlier stage of development are not included. EEP-ready policies therefore do not take into account any measures announced by the current government.

The Energy and Emissions Projections show what the UK would expect to happen if no further policies were planned or implemented (as of June 2024). As such, they provide the baseline assumptions for assessing future climate and energy policy proposals before they become EEP-ready. The projections are also used to meet the UK's international reporting obligations under the United Nations Framework Convention on Climate Change².

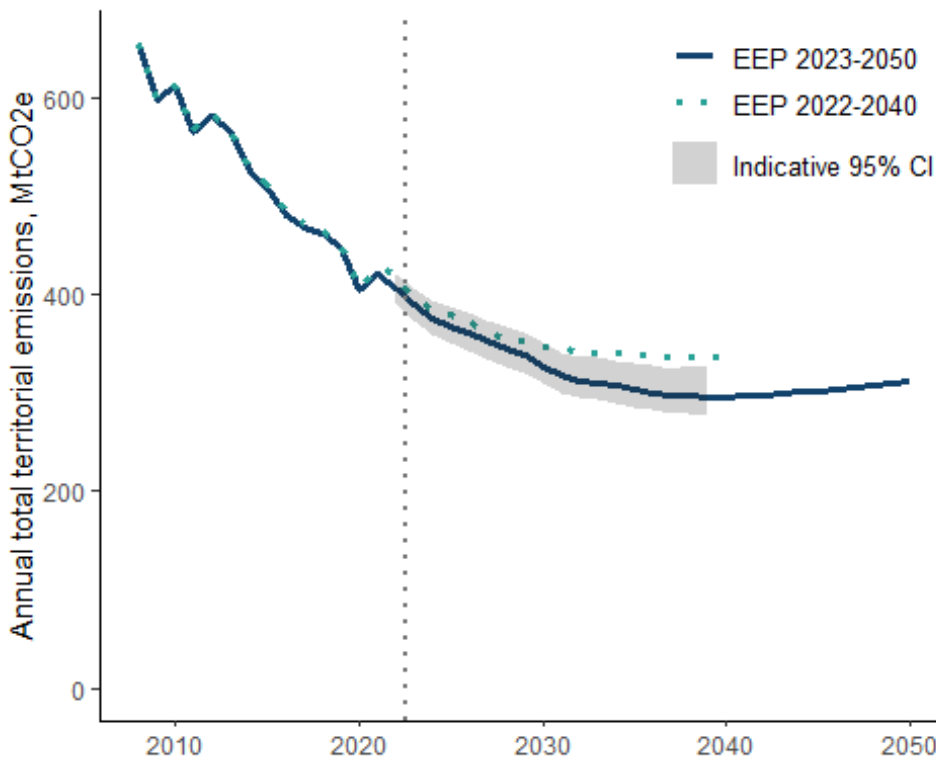
Figure i shows how EEP 2023-2050 projects lower emissions than EEP 2022-2040³ for all future years.

¹ Energy and emissions projections: <https://www.gov.uk/government/collections/energy-and-emissions-projections>

² Note this equates to the UNFCCC international reporting scenario "With Additional Measures" (WAM), which includes Existing and Planned policies.

³ EEP 2022-2040, published October 2023: <https://www.gov.uk/government/publications/energy-and-emissions-projections-2022-to-2040>

Figure i: UK projected territorial emissions (excluding IAS), MtCO₂e



Notes:

* *The uncertainty ranges are indicative and are based on modelling from EEP 2018.*

Projected emissions are lower than EEP 2022-2040 for each of the five-year periods for which the UK has set carbon budget targets under the Climate Change Act 2008. Under EEP-ready policies, we project that the UK will meet its next two legislated domestic targets (Carbon Budget 4 2023-2027 and Carbon Budget 5 2028-2032). In addition, compared to EEP 2022-2040, the latest projections show a smaller gap between projected performance and emissions target for Carbon Budget 6 (2033-2037).

Projected emissions are lower than EEP 2022-2040 for most sectors (see the emissions annexes: Annex A). The biggest decreases are seen in the domestic transport sector, where the introduction of new policies has led to a reduction in the sixth Carbon Budget period of more than 100 MtCO₂e in comparison to EEP 2022-2040. The addition of the Vehicle Emissions Trading Schemes (VETS) Order 2023 is responsible for most of this reduction. The VETS Order came into force in Great Britain in January 2024, and will set vehicle manufacturers a target for 80% and 70% of their cars and vans sales, respectively, to be zero emissions by 2030.

Projected emissions are lower than EEP 2022-2040 as a result of modelling changes to the iron and steel sector. Additionally, these account for the closure of blast furnaces in Port

Talbot, the reduction in UK coke manufacture, and the transition to the new Electric Arc Furnace⁴.

There are several other drivers of the overall lower emissions, including updates to non-CO₂ emissions projections, new policies and changes to economic assumptions. Some factors also cause an increase in emissions, including updates to fossil fuel price assumptions. These are explained in more detail later in this report.

⁴ See the background on this page: <https://www.gov.uk/government/news/government-puts-workers-at-the-heart-of-new-and-improved-port-talbot-deal>

1 Introduction

- This report contains projections of energy consumption, electricity generation, and greenhouse gas emissions under EEP-ready policies out to 2050.
- The projections take account of policies that, as of June 2024, have been implemented and those that are planned where the level of funding has been agreed and the design of the policy is near final i.e. where there are no outstanding decisions on intervention design or funding that might materially affect their impact. These policies together are referred to as “EEP-ready” policies.
- Policies that have been announced but have not reached the required EEP-ready state of development are not included.
- The Energy and Emissions Projections show what the UK would expect to happen if no further policies were planned or implemented (as of June 2024). As such, they provide the baseline assumptions for assessing future climate and energy policy proposals before they become EEP-ready. The projections are also used to meet the UK’s international reporting obligations under the United Nations Framework Convention on Climate Change⁵.
- Chapter 2 looks at our projections for overall UK territorial emissions (emissions that occur within the UK's borders) and performance against carbon budget targets.
- Chapter 3 explores the impact of policies that are new to this edition of EEP as well as changes to the estimated impacts of policies that were already included in EEP 2022-2040.
- Chapter 4 looks at the drivers and changes to projected electricity supply.
- Chapter 5 sets out more information about the major changes to the projections between EEP 2022-2040 and EEP 2023-2050.

1.1 About this document

This report sets out the 2023-2050 Energy and Emissions Projections: referred to as EEP 2023-2050⁶.

EEP provides projections of energy, emissions, and electricity generation under policies that have been implemented and those that are planned where the level of funding has been agreed and the design of the policy is near final. Policies at an earlier stage of development are not included. This is because the estimated impact of a planned policy will be sensitive to

⁵ Note this equates to the UNFCCC international reporting scenario “With Additional Measures” (WAM), which includes Existing and Planned policies.

⁶ Available at: <https://www.gov.uk/government/publications/energy-and-emissions-projections-2023-to-2050>

decisions on its design and/or level of funding. In this report, policies that have reached the required stage of development are referred to as “EEP-ready” policies.

Policies are included if they had reached the EEP-ready stage of development by June 2024. Policies therefore do not take into account any measures announced by the current government.

The Energy and Emissions Projections are produced to meet the UK’s international reporting obligations under the United Nations Framework Convention on Climate Change⁷ and to provide essential assumptions for government modelling of energy and climate change policies. The Energy and Emissions Projections show what the UK would expect to happen if no further policies were planned or implemented (as of June 2024). As such, they provide the baseline against which future climate and energy policy proposals are assessed before they become EEP-ready. Other uses include the provision of short-term electricity demand assumptions for power sector policy modelling and future industrial output assumptions for industrial decarbonisation modelling.

This report provides an overview of the updated projections and includes comparisons against EEP 2022-2040. Detailed annual breakdowns for energy, emissions and electricity generation under EEP-ready policies are contained in the accompanying annexes. In response to user feedback, Territorial Emissions Statistics (TES) sectors have now replaced National Communication (NC) sectors in DESNZ greenhouse gas emissions statistics. Therefore, for EEP 2023-2050, we have added a new annex (Annex A: TES sectors).

For sector definitions and further information on the change, see the final UK greenhouse gas emissions national statistics, known as the 1990-2022 UK Greenhouse Gas Inventory (GHGI)⁸.

The Climate Change Act 2008 (CCA) introduced carbon budgets⁹. These are legally binding limits on the total amount of greenhouse gas (GHG) emissions the UK can emit over five-year periods. Carbon budgets have been set out to 2037, with Carbon Budget 6 (2033-2037) being the latest target set. We present projected performance against carbon budgets under EEP-ready policies in Chapter 2.

The metric used to assess performance against carbon targets is called the Net UK Carbon Account (NCA). The government has committed to including International Aviation and Shipping (IAS) in CB6, whilst earlier targets do not. Therefore, we include IAS when reporting against CB6. Annex tables contain projections with and without IAS.

These projections bring together statistical and modelled information from many different sources:

⁷ Note this equates to the UNFCCC international reporting scenario “With Additional Measures” (WAM), which includes Existing and Planned policies.

⁸ Available at: <https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics>

⁹ Available at: <https://www.gov.uk/guidance/carbon-budgets>

- At the time of modelling, the main source of energy consumption data was the annual Digest of UK Energy Statistics (DUKES)¹⁰, published July 2023. The projections have not been updated to incorporate the latest estimates of energy consumption published in DUKES July 2024. The first projection year for energy consumption is therefore 2023 and we report energy consumption trends against a comparison year of 2022.
- The main source of emissions statistics is the final UK greenhouse gas emissions national statistics, the 1990-2022 UK Greenhouse Gas Inventory (GHGI)¹¹, published in February 2024. The first projection year for emissions is therefore 2023, and we report emission trends against 2022 unless we state otherwise.
- The latest Office for Budget Responsibility (OBR) short and long run economic growth projections available at the time of modelling were from March 2024¹².
- The Department for Energy Security & Net Zero (DESNZ) updated fossil fuel price projections in September 2024. See Fossil Fuel Price Assumptions for further details of the latest update¹³.
- Non-energy and non-CO₂ projections have been updated and are consistent with the 1990-2022 Greenhouse Gas Inventory (GHGI). See Annex N for details of this. These are produced by the Department for Energy Security & Net Zero (DESNZ), the Department for Energy, Food & Rural Affairs (Defra), Ricardo¹⁴ and the UK Centre for Ecology and Hydrology (CEH)¹⁵.
- Land Use, Land Use Change and Forestry (LULUCF) projections are aligned with the 1990-2022 Greenhouse Gas Inventory (GHGI) and are consistent with the inventory. These are produced by the UK Centre for Ecology and Hydrology (CEH).

We produce projections of energy demand and emissions outside the power sector by applying standard statistical techniques. These project forward energy demand and emissions based on trends and relationships in past data. We adjust these projections to take account of estimated reductions in energy consumption from EEP-ready policies. We then project energy-related emissions by multiplying energy demand by the relevant emissions factors¹⁶.

We produce projections of power sector generation and associated emissions by feeding our projections of electricity demand into a model of electricity supplier behaviour.

We obtain separate projections for non-energy related emissions from the Department for Environment, Farming & Rural Affairs (Defra), Ricardo, the UK Centre for Ecology & Hydrology

¹⁰ There is more detail here: <https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes>

¹¹ Available at: <https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics>

¹² Available at: <https://obr.uk/efo/economic-and-fiscal-outlook-march-2024/>

¹³ Available at: <https://www.gov.uk/government/collections/fossil-fuel-price-projections>

¹⁴ Ricardo Energy & Environment

¹⁵ Available at: <https://ceh.ac.uk>

¹⁶ Emissions factors are available from: <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>

(CEH) and the North Sea Transition Authority¹⁷. The accompanying methodology summary¹⁸ provides further details of the projection methodology.

1.2 The “reference scenario” and other scenarios

We refer to our main projection as the “reference scenario”. This is our core analysis of how the UK energy and emissions system could evolve under EEP-ready policies and our central assumptions about how the system drivers will change. Results in this report are from the reference scenario unless stated otherwise. They are the baseline or counterfactual projection showing what the UK would expect to happen if no policies at an earlier stage of development were implemented. Results from other EEP scenarios are provided in the accompanying annexes. These include the “With Existing Measures (WEM)”¹⁹ policy scenario which only includes policies that have already been implemented.

Finally, since the projections are sensitive to macro-economic assumptions, the annexes also include projections under alternative fossil fuel price and economic growth assumptions.

We publish our projections for the reference scenario and other scenarios in annexes alongside this report. Each chapter of this report notes the relevant annexes. The data underlying the report’s tables and figures are in the web tables and web figures supplementary files. Chapter 6 lists these resources in full.

¹⁷ Available at: <https://nstauthority.co.uk>

¹⁸ Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794741/energy-emissions-projections-methodology-overview.pdf

¹⁹ “WEM” stands for the “With Existing Measures” scenario used for international reporting to UNFCCC.

2 UK emissions projections

- Under EEP-ready policies only, emissions are projected to fall by 23% between 2022 and 2050.
- Under EEP-ready policies only, the projections show headroom of 104 MtCO_{2e} against the fourth Carbon Budget and headroom of 83 MtCO_{2e} for the fifth Carbon Budget period.
- The scope of emissions included in Carbon Budget 6 (CB6) projections widens to include International Aviation and Shipping. For CB6 the projected shortfall is 779 MtCO_{2e}.

2.1 Introduction

This chapter looks at our projections for overall UK territorial emissions and performance against carbon budget targets.

Emissions estimates in this publication include seven greenhouse gases as defined by the Climate Change Act 2008²⁰: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), and nitrogen trifluoride (NF₃). HFCs, PFCs, SF₆, and NF₃ are collectively referred to as fluorinated- or F-gases.

Emissions from each greenhouse gas are weighted by its Global Warming Potential (GWP), so that total greenhouse gas emissions can be reported on a consistent basis in terms of carbon dioxide equivalent (CO_{2e}). In November 2021, it was agreed by the international community at the 2021 United Nations Climate Change Conference (COP26) that greenhouse gases shall be reported under the Paris Agreement transparency framework using 100-year GWPs listed in table 8.A.1 of the Fifth IPCC Assessment Report (AR5 without climate-feedback)²¹. Therefore, all projections and comparisons in this report and in the accompanying EEP 2023-2050 annex tables are reported on this basis.

2.2 UK emissions projections and uncertainty

In this section, we compare emissions with EEP 2022-2040²². For convenience, we use the carbon budget periods to summarise projection results. These are not the same as the Net

²⁰ Climate Change Act 2008: <https://www.legislation.gov.uk/ukpga/2008/27/part/1/crossheading/targeted-greenhouse-gases>

²¹ Fifth IPCC Assessment Report: <https://unfccc.int/documents/311138>

²² EEP 2022-2040, published October 2023: <https://www.gov.uk/government/publications/energy-and-emissions-projections-2022-to-2040>

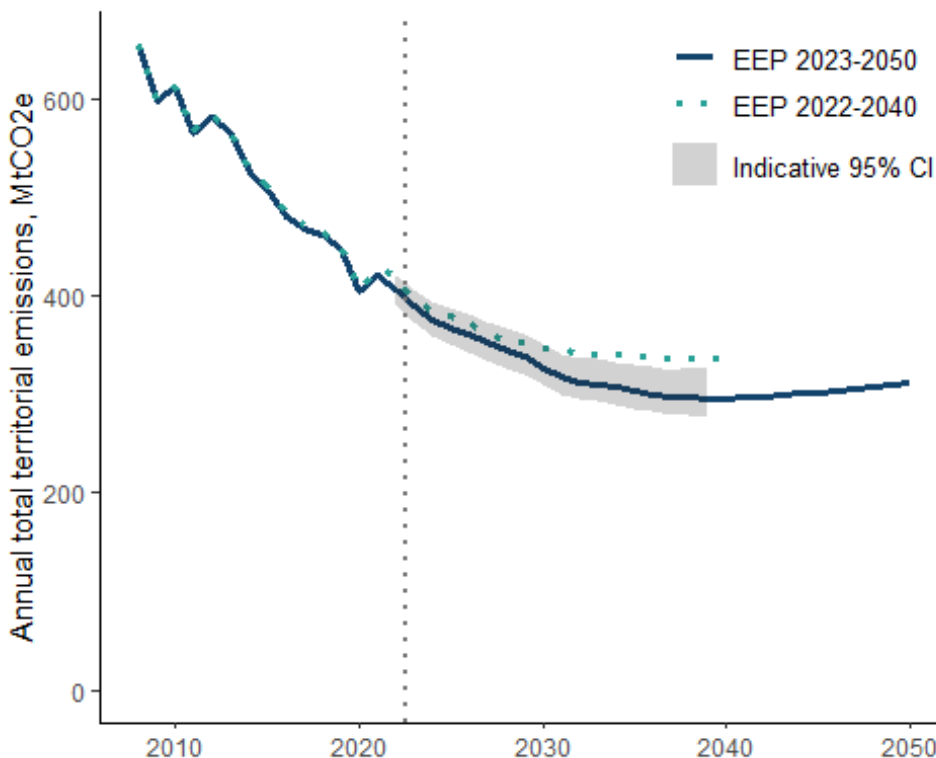
Carbon Account (NCA) metric used to assess performance against carbon budget targets: see section 2.3 and Box 1 for details.

Figure 2.1 compares the main territorial emissions trends from EEP 2023-2050 with those from EEP 2022-2040.

When we compare total UK territorial emissions (excluding IAS) for carbon budget periods four to six, EEP 2023-2050 has lower projected emissions than EEP 2022-2040 for all carbon budget periods, with the difference between the updated and previous projections increasing over the course of the projection period:

- For the fourth Carbon Budget period they are 51 MtCO₂e (3%) lower.
- In the fifth Carbon Budget period, territorial emissions are lower than in EEP 2022-2040 by 104 MtCO₂e (6%)
- In the sixth Carbon Budget period they are 175 MtCO₂e (10%) lower.

Figure 2.1: UK projected territorial emissions (excluding IAS), MtCO₂e



Notes:

* The uncertainty ranges are indicative and are based on modelling from EEP 2018.

2.3 Progress towards the carbon budgets

The UK has domestic targets for reducing greenhouse gas emissions under the Climate Change Act 2008 (CCA). In June 2019, the CCA was amended to commit the UK to achieving a 100% reduction in net emissions by 2050 from the base year (Net Zero).

The UK met the first (2008-12), second (2013-17) and third (2018-2022) carbon budgets. The latest carbon budget to be set was the sixth Carbon Budget covering the period 2033 to 2037.

Performance against carbon budget targets is assessed by comparing the budget level against a metric called the UK “Net Carbon Account” (NCA). Box 1 outlines details of how the NCA is calculated.

Box 1: The UK net carbon account (NCA)

2023 onwards:

In this publication, the net carbon account is defined as the sum of two components:

1. **All UK territorial emissions:** In the sixth Carbon Budget (2033-37), emissions from UK international aviation and shipping (IAS) are also in scope²³.
2. **Credits/debits from international trading systems:** This is currently assumed to be zero²⁴.

Figure 2.2 shows projected performance against the carbon budgets under EEP-ready policies. Table 2.1 also details projected performance against carbon budgets.

We project headroom of 104 MtCO₂e in the fourth Carbon Budget and 83 in the fifth Carbon Budget, under EEP-ready policies. In the sixth Carbon Budget we project a shortfall of 779 MtCO₂e. Projections of performance under EEP-ready policies has improved slightly in all carbon budget periods. The projected NCA metric used to assess performance against targets includes IAS in the sixth Carbon Budget but not in earlier carbon budgets. Therefore, projected NCA emissions are higher in CB6 than in CB5.

²³ In line with current international reporting guidelines, IAS emissions estimates are assumed to be based on the amount of refuelling from bunkers at UK airports and ports, whether by UK or non-UK operators, for onward international journeys.

²⁴ While the UK intends to meet its carbon budget targets through reducing emissions domestically, it reserves the right to credit and debit carbon units to the NCA under the Climate Change Act 2008. This could occur through linking the UK ETS to another emissions trading system, or through the use of international emissions reductions or removals units.

Figure 2.2: Projected performance against carbon budgets under EEP-ready policies, MtCO₂e

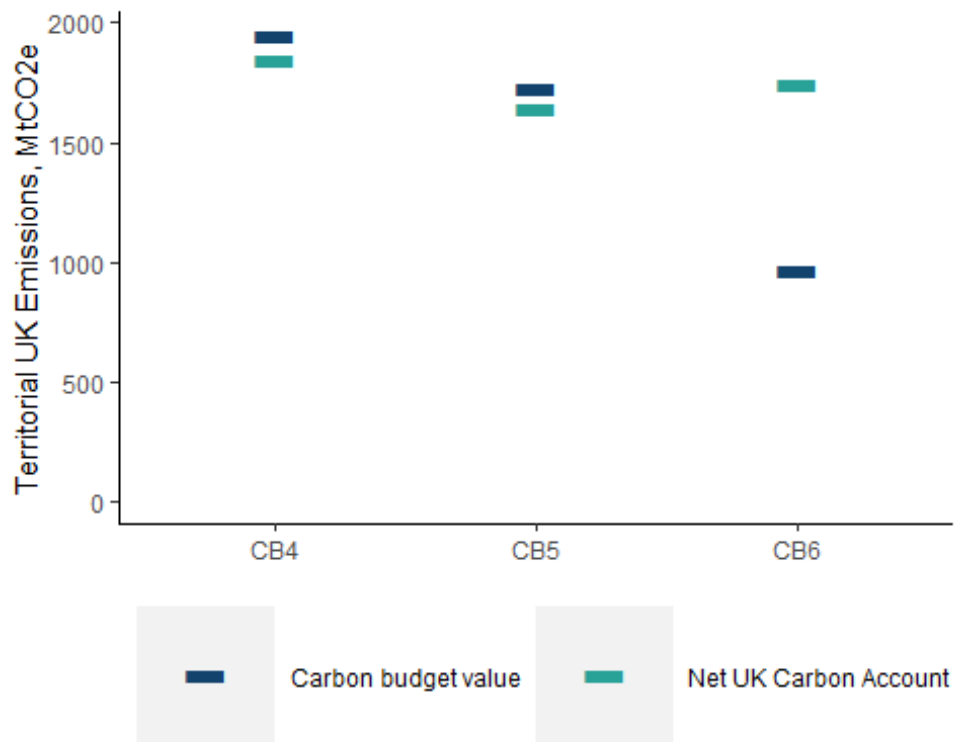


Table 2.1: Territorial and Net Carbon Account emissions projections across carbon budget periods, MtCO_{2e}

	CB4	CB5	CB6
	(2023-27)	(2028-32)	(2033-37)
Carbon budget target	1,950	1,725	965
<i>Projected territorial and Net Carbon Account (NCA) emissions</i>			
Territorial emissions exc. IAS	1,846	1,642	1,519
Territorial emissions inc. IAS	2,062	1,862	1,744
Projected performance vs target (projected NCA minus CB target)	-104	-83	779
<i>Average annual percentage reduction on base year [2] emissions</i>			
Implied carbon budget/NCA target	-52%	-58%	-77%
Projected Net Carbon Account (exc. IAS)	-55%	-60%	
Projected Net Carbon Account (inc. IAS)			-58%

Notes:

- [1] All data based on reference case.

- [2] The base year is 1990 for CO₂, CH₄ and N₂O, and 1995 for fluorinated gases. For CB4-5, base year emissions are currently estimated to be 815 MtCO_{2e}. CB6 base year emissions include an additional 24 MtCO_{2e} for international aviation and shipping. Base year emissions estimates on which CB percentage reductions are based are revised annually and are therefore subject to change.

3 Effect of policies on emissions

- Policies are included in these projections if they had either been implemented or were planned and at a near final stage of development by the policy cut-off point (June 2024 for all policies). These are together referred to as “EEP-ready” policies.
- Within this chapter, we now include the total of territorial and international aviation and shipping (IAS) policy savings. Relative to no policy intervention, we project that EEP-ready quantified government policies (excluding power section interventions) will reduce total emissions (including IAS) by around 298 MtCO_{2e} in the fourth Carbon Budget period, 415 MtCO_{2e} in the fifth and 537 MtCO_{2e} in the sixth Carbon Budget period.
- The new individually quantified policies that are included for the first time in EEP 2023-2050 are: the Energy Savings Opportunity Scheme (ESOS) - Improvements (Industrial Processes), the Industrial Energy Transformation Fund (IETF) Phase 3 Extension and the Pilot Energy Advice Service. Within the transport sector updates, the impact of two new policies has been included, the Vehicle Emissions Trading Schemes (VETS) Order 2023 and the Sustainable Aviation Fuel mandate.

3.1 Introduction

This chapter explores the impact of policies that are new to this edition of EEP as well as changes to the estimated impacts of policies that were already included in EEP 2022-2040.

A full list of policies included in EEP 2023-2050 is available in Annex D. We also provide quantified impacts for individual policies in Annex D where these are available.

Most policies included in EEP have individually quantified impacts. However, we cannot currently provide separate quantified impacts for some types of policy due to limitations with our modelling approach:

- Power sector, forestry and agriculture policies are modelled as three separate policy groupings, and the impact of individual policies cannot be separated out due to interactions between them.
- Policies which operate fully or partly through a price impact such as the Climate Change Levy (an environmental tax on the energy that businesses use) cannot be quantified due to limitations with our modelling approach. These are taken into account in the modelling (through their impact on energy demand), but we do not have estimates of the individual impacts.
- Some policies and initiatives are not taken into account in our modelling. These will only be picked up in the projections if their combined past impact is sufficiently large to affect long term trends. These include:

- Enabling policies, such as innovation funding or investment in infrastructure.
- Policies implemented by Devolved Administrations (DAs).
- Initiatives by local authorities or other public, voluntary, or private sector organisations unless these are directly driven by a central government initiative.

3.2 Policies for emissions reduction

Table 3.1 shows that we estimate that quantified government policies (excluding power sector interventions) will reduce total emissions (including IAS) by 1,250 MtCO₂e over carbon budgets four to six. We report policy savings in Annex D: this gives brief information about the policies we include.

Table 3.1: Projected GHG emissions savings from EEP-ready policies excluding power sector interventions, MtCO₂e

	CB4	CB5	CB6	Total
	(2023-27)	(2028-32)	(2033-37)	(2023-37)
Savings from policies excluding power sector	298	415	537	1,250

3.3 Changes to individually quantified policy savings since EEP 2022-2040

From the fourth Carbon Budget period onwards, we project higher total GHG savings from EEP-ready government policies excluding power sector interventions compared with EEP 2022-2040 projections.

These policy savings for the fourth Carbon Budget period have increased from 294 to 298 MtCO₂e (so overall emissions in the projections are 4 MtCO₂e lower). In the long term we project higher EEP-ready policy savings excluding power sector interventions than in previous projections. For the fifth Carbon Budget period these savings have increased overall in EEP 2023-2050, from 355 to 415 MtCO₂e. For the sixth Carbon Budget period, they are 537 MtCO₂e, an increase of 124 MtCO₂e from EEP 2022-2040.

Policies with the largest change in savings from previous projections include:

- Road transport policies: Road transport policy savings have substantially increased since EEP 2022-2040, resulting in lower projected emissions in the transport sector. This is mainly driven by the implementation of the Vehicle Emissions Trading Schemes (VETS) Order 2023, commonly known as the ZEV Mandate. The VETS Order came into

force in Great Britain in January 2024, and will set vehicle manufacturers a target for 80% and 70% of their cars and vans sales respectively, to be zero emissions by 2030. Further legislation is required to take targets to 100% by 2035, meaning post-2030 targets cannot be included in EEP until this is finalised. For EEP 2023-2050, the savings from road vehicle policies are 7 MtCO_{2e} higher in the fourth Carbon Budget period than in EEP 2022-2040. The savings then increase to 51 MtCO_{2e} in the fifth Carbon Budget period and 104 MtCO_{2e} in the sixth Carbon Budget period.

- **Aviation policies:** The Sustainable Aviation Fuel (SAF) mandate is included in the EEP for the first time this year²⁵. Aviation policies are projected to contribute 5, 20 and 28 MtCO_{2e} of savings in the fourth, fifth and sixth carbon budget periods respectively. The majority of these savings are in the international aviation and shipping (IAS) sector, and therefore only affect performance against carbon budget targets from the sixth Carbon Budget onwards.
- **Other new EEP-ready policies:** In addition to new transport policies, there are three new EEP-ready policies in other sectors included in EEP 2023-2050. These are the Energy Savings Opportunity Scheme (ESOS) - Improvements (Industrial Processes), the Industrial Energy Transformation Fund (IETF) Phase 3 Extension and the Pilot Energy Advice Service and in total they are projected to contribute 1 MtCO_{2e} of savings in each of carbon budget periods 4, 5 and 6.
- **Resources and Waste Strategy:** There are no changes to landfill emissions projections since EEP 2022-2040. This is because Defra's update to waste emissions modelling is still in progress. We cannot yet quantify the impact on the capture of landfill gas of ending Renewal Obligation support for landfill gas electricity generation. This support is due to end from 2027 (~85% of contracts in 2027) with a potential negative impact on landfill gas capture. The most recent estimate of the methane capture rate at landfills is approximately 56%. This means that each percentage point reduction in landfill gas capture would likely increase methane emissions by more than 2 per cent.

3.4 Emissions savings from policies in electricity supply

A range of government policies have reduced emissions in the Electricity Supply Industry since the Low Carbon Transition Plan (LCTP) - electricity supply emissions have fallen by 64% between 2009 and 2022.

Supply-side policies comprise:

- Large Combustion Plant Directive
- Industrial Emissions Directive

²⁵ SAF mandate 2041-2050 emissions savings reflect policy ambition rather than legislation.

- UK Carbon Price Support
- Feed-in-Tariffs (for small scale generation)
- Renewables Obligation and Contracts for Difference (for large-scale generation)
- Phase out of coal-fired generation
- Capacity Market

Power supply markets are highly interconnected, meaning it is not possible to robustly disaggregate the impacts of individual policies. We are reviewing the method for calculating savings from overall power interventions. For this edition, we have excluded the aggregated emissions savings from power supply policies in the “All by sector” section of Annex D.

4 Electricity supply

- Electricity supply policies are included if they had reached the “EEP-ready” stage by June 2024 - that is, were either implemented or were planned and at a near final stage of design with funding agreed by that date.
- Given these assumptions, generation from renewables is projected to grow from 131 TWh in 2022 to 302 TWh by 2050 under EEP-ready policies (i.e. if there were no further CfD support beyond announced allocation rounds and no further support measures were introduced).

4.1 Introduction

This chapter explores the drivers and changes to projected electricity supply and associated emissions.

We produce projections of power sector generation and associated emissions by feeding our projections of electricity demand into a model of electricity supplier behaviour. We undertook this electricity supply sector modelling in August 2024 using DESNZ’s “Dynamic Dispatch Model” (DDM)²⁶. The DDM simulates the dispatch of electricity in half-hourly periods out to 2050 taking into account numerous factors such as fuel costs and balancing requirements. The model also projects what new generation capacity will be required to ensure security of supply in future years.

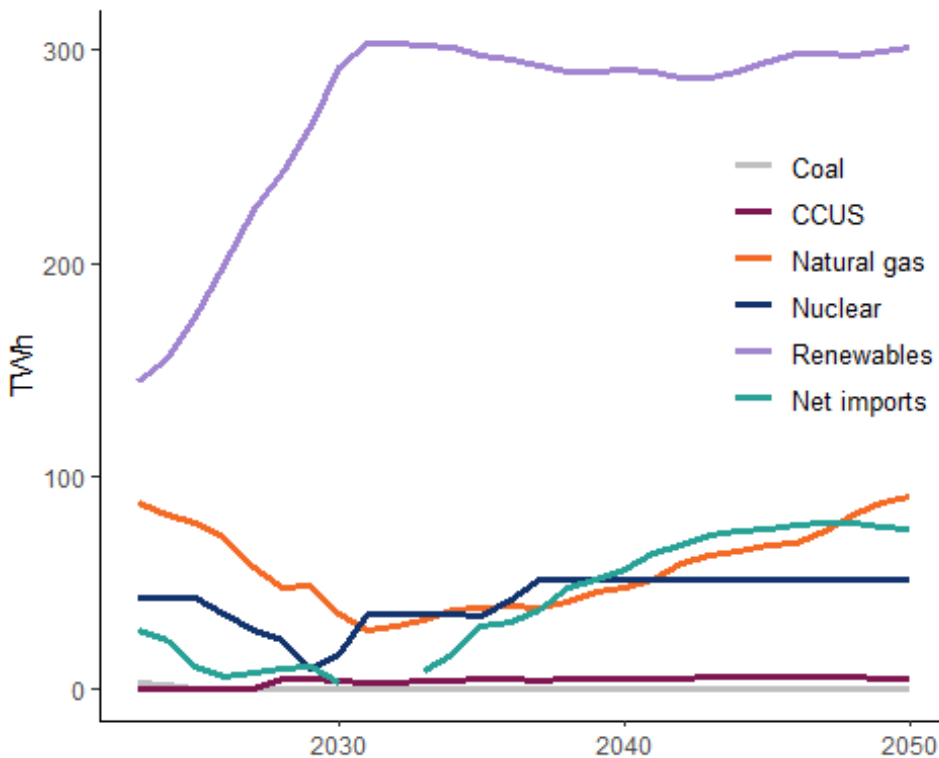
Electricity supply policies are included if they had reached the “EEP-ready” stage by June 2024 - that is, were either implemented or were planned and at a near final stage of design with funding agreed by that date. This cut-off date means that the current government’s clean power in 2030 mission is not therefore included. EEP-ready policies in the power sector include the pipeline of renewable capacities from future Contract for Difference (CfD) rounds, one pilot Carbon Capture and Storage (CCS) plant and the nuclear plants Sizewell C (SZC) and Hinkley Point C.

4.2 Summary of projections

Our projections of electricity generation by fuel over time is shown in Figure 4.1 below.

²⁶ For background information on the DDM please see: <https://www.gov.uk/government/publications/dynamic-dispatch-model-ddm>

Figure 4.1: Electricity generation by fuel source, TWh



- We project generation from renewables will rise, as renewable projects are confirmed to come online through CfD Allocation Rounds 4 through 6.
- Natural gas generation responds to this increasing low carbon generation by falling rapidly until the late 2020s. It then stabilises as less new low carbon generation capacity comes online based only on EEP-ready policies. By 2040 it will be around 48 TWh, 61% lower than 2022 levels. This compares with 34 TWh in the previous edition.
- We project that nuclear generation will fall slightly during the 2020s as older plants retire, but rise again as Hinkley Point C and Sizewell C come online.
- More storage comes online through the capacity market as a more renewables-intensive generation mix means more opportunities for storage technologies to make profit, taking advantage of lower wholesale prices during times when renewables would otherwise be curtailed.

5 Detailed comparisons with EEP 2022-2040

5.1 Introduction

This chapter sets out more information about the major changes to the projections since last year. For convenience, we use the carbon budget periods to summarise projection results.

All breakdowns here are based on total emissions including International Aviation and Shipping (IAS). (In previous editions, this chapter excluded IAS, but now we have some policy savings for international aviation, we are including IAS in chapter 5).

5.2 Changes in emissions (including international aviation and shipping) since EEP 2022-2040

We update the projections each year to incorporate a range of updated scientific evidence, statistics, and projections of economic and demographic drivers, as well as updated estimates of policy impacts and improvements to projections methodology and modelling. Table 5.1 summarises the contribution of each of these changes to overall emissions estimates.

Table 5.1: Changes which affect total emissions projections including aviation and shipping (in comparison with EEP 2022-2040), MtCO₂e

	CB4	CB5	CB6
	(2023-27)	(2028-32)	(2033-37)
Macro-economic, power sector and other model input updates	-10	-8	-24
Inventory, Non-CO2 and LULUCF updates	-3	-18	-17
Policy savings updates (DESNZ and MHCLG)	-2	-2	-3
Transport assumption and policy updates	-18	-57	-104
Modelling and assumption changes	-21	-25	-29
Total	-53	-111	-177

In more detail these changes are:

- **Transport assumption and policy updates:** This is the combined effect of updates to inputs, assumptions and policies. The net effect of these was to reduce emissions by 18 MtCO_{2e} in CB4, with the reduction getting significantly larger over each subsequent carbon budget period. Projected emissions (including international aviation and shipping) for the fifth and sixth Carbon Budget periods are 57 and 104 MtCO_{2e} lower than in EEP 2022-2040 respectively. We discussed policy savings in Chapter 3. Compared with EEP 2022-2040, there have been significant savings driven by new policies, in particular the implementation of the VETS, which has contributed the biggest reduction in emissions of all policies. New aviation policies have also been introduced, notably the SAF mandate.
- The table above combines the effect of assumption and policies, but just looking at the emissions change due to DfT policies shows a decrease of 10 MtCO_{2e} for CB4, 66 MtCO_{2e} in CB5 and 124 MtCO_{2e} in CB6. See section 3.3 for more details.
- **Modelling and assumption changes** lead to lower projected emissions than in EEP 2022-2040, as a result of changes to the modelling of iron and steel emissions. The methodology has been improved by separating out blast furnace and electric arc furnace production and aligning emissions from different processes more closely to the relevant production projection. Additionally, these modelling changes include an adjustment for the closure of blast furnaces in Port Talbot, the reduction in UK coke manufacture, and the transition to the new Electric Arc Furnace²⁷. The emissions are lower by 21 MtCO_{2e} in the fourth Carbon Budget period, 25 MtCO_{2e} in the fifth Carbon Budget period and 29 MtCO_{2e} in the sixth Carbon Budget period.
- **Macro-economic, power sector and other model input updates** This group combines revisions to power sector modelling and other model inputs (for example fossil fuel price updates and economic growth). See section 4.3 for more details of power sector updates and section 5.2.1 for more details of input updates. Updates to these assumptions mean that emissions projections are lower than EEP 2022-2040 by 10 MtCO_{2e} in the fourth Carbon Budget period. After this, the fifth Carbon Budget period is projected to be 8 MtCO_{2e} lower than EEP 2022-2040 and the sixth Carbon Budget period is lower by 24 MtCO_{2e}.
- **Inventory, LULUCF and non-CO₂ emission data:** updated historic data from the GHG Inventory and new projections of non-CO₂ emissions mean that emissions have been revised downwards from EEP 2022-2040 - by 3 MtCO_{2e} in the fourth Carbon Budget period, 18 MtCO_{2e} in the fifth Carbon Budget period and 17 MtCO_{2e} in the sixth.
- **Policy savings updates for DESNZ and MHCLG climate change policies:** The new policies (described in more detail in Chapter 3) helped to reduce emissions slightly over all carbon budget periods. For this row, we just include DESNZ and MHCLG policies.

²⁷ See the background on this page: <https://www.gov.uk/government/news/government-puts-workers-at-the-heart-of-new-and-improved-port-talbot-deal>

For these, the change was due to a couple of revisions to existing policies, as well as the removal of one policy that was included in EEP 2022-2040. Overall, there were 2, 2 and 3 MtCO_{2e} more emissions savings than EEP 2022-2040 for the fourth, fifth and sixth carbon budget periods respectively.

5.2.1 Changes to projections of emissions (including international aviation and shipping) due to input updates

Table 5.2 further breaks down the changes in ‘Macro-economic, power sector and other model input updates’ (as featured in aggregate in Table 5.1) and their effect on emissions. The overall impact of changes to inputs varies over time, and led to a decrease in projected emissions of 10 in Carbon Budget 4, 8 in Carbon Budget 5 and a larger decrease of 24 MtCO_{2e} in Carbon Budget 6.

Table 5.2: Input updates which affect emissions projections including international aviation and shipping (in comparison with EEP 2022-2040), MtCO_{2e}

	CB4 (2023-27)	CB5 (2028-32)	CB6 (2033-37)
Fossil fuel, retail and carbon prices	14	12	4
Power sector updates	5	7	-1
Demographic: Households and population	0	0	1
projections Winter Degree Days	-2	0	0
DUKES update	-12	-11	-12
Economic assumptions (GDP, exchange rate etc)	-14	-16	-15
Total	-10	-8	-24

Notes:

- [1] The DUKES update row does not include transport: the “Transport assumption and policy updates” row in Table 5.1 captures these changes.

Compared with EEP 2022-2040, the main revisions to emissions leading to an increase in the projections come from updates to:

- **Fossil fuel, retail and carbon price assumptions:** The projected gas price is substantially lower than assumed for EEP 2022-2040 over CB4 and CB5, and slightly lower over the rest of the projection period. When combined with other price change

assumptions, which have little impact on emissions, this leads to higher projected emissions (mainly in the domestic sector) for the fourth Carbon Budget period of 14 MtCO_{2e}, 12 MtCO_{2e} in the fifth Carbon Budget period, and 4 MtCO_{2e} in the sixth Carbon Budget period.

- **Power sector updates and interaction:** Since EEP 2022-2040, power sector modelling has been updated.

The main revisions to emissions leading to a decrease in the projections come from updates to:

- **Economic assumptions:** The decrease in emissions from updates to the economic assumptions is mainly driven by the Blue Book 2023 changes on gross domestic product²⁸, specifically revisions to gross value added (GVA). There were substantial downward revisions to GVA from the production and manufacturing sectors, with volume estimates for energy falling. This revision has led to emissions being projected at a lower level than in EEP 2022-2040.

²⁸ The blue book changes are available at:
<https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/impactofbluebook2023changesongrossdomesticproduct/2023-09-01>

6 Lists of supporting material

6.1 Annexes

For this edition we have published the demand annexes (Annex E and F) with versions in both ktoe/Mtoe and TWh. We plan to move to publishing just the TWh version in future years, but please let us know at the following email address if you need the older version: emissionsprojections@energysecurity.gov.uk.

Annex A: Greenhouse gas emissions by source

Annex A NZS Categories: Greenhouse gas emissions by source

NEW: Annex A TES Categories: Greenhouse gas emissions by source

Annex B: Carbon dioxide emissions by source

Annex C CO₂: Carbon dioxide emissions by IPCC category

Annex C Non-CO₂: Non-CO₂ greenhouse gas emissions by IPCC category

Annex D: Policy savings in the projections

Annex E: Primary energy demand (versions in both Mtoe and TWh)

Annex F: Final energy demand (versions in both ktoe and TWh)

Annex G: Major power producers' generation by source

Annex H: Major power producers' cumulative new electricity generating capacity

Annex I: Major power producers' total electricity generating capacity

Annex J: Total electricity generation by source

Annex K: Total cumulative new electricity generating capacity

Annex L: Total electricity generating capacity

Annex M: Growth assumptions and prices

Annex N: 2023 non-CO₂ GHG emissions projections report

Our annexes contain projections for the following scenarios, most of which we publish each year:

Scenario	Description
Reference Scenario	Based on central estimates of economic growth and fossil fuel prices. Contains policies that have already been implemented and those planned policies (“EEP-ready” policies). See annex D on policy savings for definitions of each policy implementation status.
Low Prices	Similar assumptions to reference scenario but with lower projected fossil fuel prices.
High Prices	Similar assumptions to reference scenario but with higher projected fossil fuel prices.
Low Growth	Similar assumptions to reference scenario but with lower projected economic growth.
High Growth	Similar assumptions to reference scenario but with higher projected economic growth.
Existing Policies	UNFCCC With Existing Measures scenario. Contains central price and growth assumptions but without any planned policies included.

Until EEP 2021-2040 we included a scenario called ‘Pre-LCTP baseline’. Due to challenges in modelling the power sector under this scenario and feedback from users that a no policy scenario would better meet their needs we have discontinued this scenario. Instead, we aim in the next couple of years to produce a scenario called ‘without policies’ which will exclude all demand-side policies and which would ideally be included in future as part of the UK’s international reporting requirements.

6.2 Web tables and figures

We publish web tables and figures alongside this report. These mainly replicate tables and figures in the report text, and one is supplementary.